

Name \_\_\_\_\_ Period \_\_\_\_\_ Date \_\_\_\_\_

# Physics Study Guide

## Newton's Laws Definitions

Newton's 1st Law of Motion: *also known as* \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Give 2 examples of the 1<sup>st</sup> Law:

- 1.
- 2.

Newton's 2<sup>nd</sup> Law of Motion: *also known as* \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Give 2 examples of the 2<sup>nd</sup> Law:

- 1.
- 2.

Newton's 3<sup>rd</sup> Law of Motion: *also known as* \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Give 2 examples of the 3<sup>rd</sup> Law:

- 1.
- 2.

Give 3 natural examples of unbalanced forces around us.

- 1.
- 2.
- 3.

From the 1<sup>st</sup> Law lab, explain why the penny fell straight down into the cup instead of remaining on the index card:

\_\_\_\_\_  
\_\_\_\_\_

Define Inertia and give an example \_\_\_\_\_  
\_\_\_\_\_

Calculate the force necessary to accelerate the following vehicles at the rate of acceleration shown in the illustration.



M=5025 kg  
A=25 m/s<sup>2</sup>

Force = \_\_\_\_\_



M=115 kg  
A= 3 m/s<sup>2</sup>

Force = \_\_\_\_\_

What is the formula for force? Which of Newton's Laws includes the formula for force? Draw the magic triangle correctly for this formula,

Define Acceleration \_\_\_\_\_

How does the mass of an object affect its acceleration? \_\_\_\_\_

How does the force applied affect its acceleration? \_\_\_\_\_

4 bicycles were in a race. The mass and acceleration of each one is recorded in the table to the right. Which had the least force?

| Bike | Mass (kg) | Acceleration (m/s <sup>2</sup> ) |
|------|-----------|----------------------------------|
| 1    | 55        | 6                                |
| 2    | 58        | 7                                |
| 3    | 50        | 4                                |
| 4    | 53        | 6                                |

The masses of four vehicles and the net forces acting on them as they enter a highway are recorded in the table below.

Vehicles Entering a Highway

| Vehicle | Mass (kg) | Force (N) |
|---------|-----------|-----------|
| Sedan   | 1500      | 4500      |
| Coupe   | 1200      | 4500      |
| SUV     | 1800      | 4500      |
| Truck   | 2000      | 4500      |

Which vehicle has the greatest acceleration as it enters the highway, using the data table above?

Plug in the given values for Force/Mass/Acceleration to solve.  
Remember, mass is in kg -- force in N (newtons) -- acceleration is in  $m/s^2$

1. What is the force on a 1000 kg elevator that is falling freely at  $9.8 m/sec^2$ ?
2. What is the acceleration of a 50 kg object pushed with a force of 500 newtons?
3. A 50 kg skater pushed by a friend accelerates  $5 m/sec^2$ . How much force did the friend apply?
4. A force of 250 N is applied to an object that accelerates at a rate of  $5 m/sec^2$ . What is the mass of the object?
5. If a 60 kg person on a 15 kg sled is pushed with a force of 300 N, what will be person's acceleration?
6. A 5 kg block is pulled across a table by a horizontal force of 40 N with a frictional force of 8 N opposing the motion. Calculate the acceleration of the object.

Determine which of Newton's laws of motion is best described and write it on the line provided.

- a. A fireman turns on his hose & is knocked backwards. \_\_\_\_\_
- b. A soccer ball will not move until a player kicks it. \_\_\_\_\_
- c. more force = more acceleration \_\_\_\_\_
- d. If air is let out of a balloon quickly, air pushes down & balloon goes up \_\_\_\_\_
- e. It takes less force to push a bike than a motorcycle \_\_\_\_\_
- f. A bowling ball hits the pins sending the pins flying for a STRIKE! \_\_\_\_\_
- g. Feet push down on the floor & the floor pushes up at feet as you walk \_\_\_\_\_
- h. In a plane taking off you feel pushed back into your seat \_\_\_\_\_
- i. Push a large box & a small box with the same force, the small box will go faster \_\_\_\_\_
- j. A boy can throw a football farther than his friend because he uses more force \_\_\_\_\_
- k. When you push on a door it pushes back with = and opposite force \_\_\_\_\_
- l. Someone crashes their bike into a rock & is thrown over it to the ground \_\_\_\_\_

Name \_\_\_\_\_

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Date \_\_\_\_\_

**Marble Olympics: Inertia and Mass**

**Section A:**

**Learning Targets:**  
 1. I can analyze a diagram and scenario.  
 2. I can explain the relationship between mass and inertia.

**Success Criteria -** Analyze the diagram to the right using the following steps:  
 a. Read your learning targets and know the terms you need to understand this lesson.  
 b. Read the labels and the Facts statements.  
 c. Write a statement that expresses the general idea of the information. *In your statement answer the following questions:*  
 i. *What happened?*  
 ii. *What factors must have caused this?*  
 d. Write the trend the diagram illustrates.

**Marble Olympics**

**Facts:**  
 1. All marbles are made up of different materials (glass, light wood, solid steel).  
 2. All marbles are the same size.  
 3. All marbles were traveling at the same constant velocity before hitting the sticky tape.  
 4. Sticky tape was equally sticky throughout the entire piece of tape.

**General Statement:**  
 \_\_\_\_\_

**Trend:**  
 \_\_\_\_\_

*\*Hint - compare each marble and determine what factor caused a difference in the location of each marble when it finished.*

**Analysis**

Complete the following statements.

The only variable that could make such a difference in the marbles results is \_\_\_\_\_.

The \_\_\_\_\_ of each marble naturally affects the \_\_\_\_\_ of each marble (or the resistance to change its motion).

Based on these facts, marble A is made of \_\_\_\_\_  
 marble B is made of \_\_\_\_\_  
 and marble C is made of \_\_\_\_\_.

**Section B:** 1. There are 3 marble olympic events shown below. Facts: All marbles are the same size and all marbles are traveling the same constant velocity before the obstacle is presented. 2. Based on the results, determine which marble is glass, light wood, and solid steel. 3. Label each of the marbles and write a sentence that explains your answer. 4. Use the success criteria to guide your work.

The challenge for our marbles here is to continue spinning despite the obstacle above them.

Here are the results

| Time spinning | Marble | Material of Marble - why |
|---------------|--------|--------------------------|
| 1 minute      | A      |                          |
| 2 minute      | C      |                          |
| 2.5 minute    | B      |                          |

The challenge for our marbles here is to stay in the air despite the air resistance in front of them. The distance is marked from where they landed.

| Marble | Material and Why |
|--------|------------------|
| A      |                  |
| B      |                  |
| C      |                  |

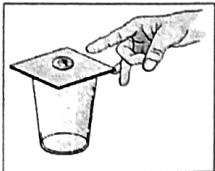
The challenge for our marbles here is to move quickly and further. The distance is marked where they stopped rolling.

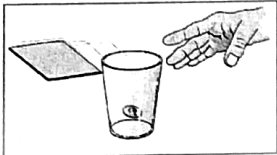
| Marble | Material and Why |
|--------|------------------|
| A      |                  |
| B      |                  |
| C      |                  |

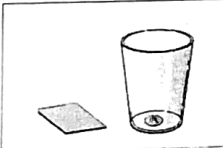
**Section C:** In the space below write the relationship between mass and inertia.

## Newton's 1st Law

|   |  |
|---|--|
| <p><b>Learning Targets</b></p> <ol style="list-style-type: none"> <li>1. I can make claims that are supported with evidence and reasoning.</li> <li>2. I can find evidence for Newton's 1st Law of inertia.</li> <li>3. I can explain Newton's 1st Law of inertia.</li> </ol> | <p><b>Success Criteria:</b></p> <ol style="list-style-type: none"> <li>1. Select one object and determine whether it is at rest or in motion with constant velocity.</li> <li>2. Identify if the forces acting on the object are balanced or unbalanced.</li> <li>3. If the forces are unbalanced, determine what force is the cause.</li> </ol> |
|---|--|

|   |   |  |
|---|---|--|
| <p>Claim: The image represents Newton's Law of inertia.</p>  <p style="text-align: center; font-size: small;">Figure 1</p> | <p>Evidence:</p> <p>The _____ is (at rest/in motion.)</p> <p>The forces acting on the _____ are (balanced/unbalanced) because _____</p> | <p>Reasoning:</p> <p>Newton's 1st law states that anything at rest will stay at rest unless acted upon by an unbalanced force.</p> <p>Until the index card is removed all the forces acting on the penny are balanced.</p> |
|---|---|--|

|   |   |  |
|---|---|--|
| <p>Claim: The image represents Newton's Law of inertia.</p>  <p style="text-align: center; font-size: small;">Figure 2</p> | <p>Evidence:</p> <p>The _____ is (at rest/in motion.)</p> <p>The forces acting on the _____ are (balanced/unbalanced) because _____</p> | <p>Reasoning:</p> <p>Newton's 1st law states that anything in motion will stay in motion at a constant velocity unless acted upon by an unbalanced force.</p> <p>Until the penny lands at the bottom of the cup, forces acting on the penny are unbalanced causing its motion to change.</p> |
|---|---|--|

|   |   |   |
|---|---|---|
| <p>Claim: The image represents Newton's Law of inertia.</p>  <p style="text-align: center; font-size: small;">Figure 3</p> | <p>Evidence:</p> <p>The _____ is (at rest/in motion.)</p> <p>The forces acting on the _____ are (balanced/unbalanced) because _____</p> | <p>Reasoning:</p> <p>Newton's 1st law states that anything at rest will stay at rest unless acted upon by an unbalanced force.</p> <p>There is no unbalanced force acting on the penny.</p> |
|---|---|---|

|   |                  |
|---|------------------|
| <p>Claim: The image label 1 represents Newton's Law of inertia.</p> | <p>Evidence:</p> |
| <p>Reasoning:</p>   |                  |

|   |                  |
|---|------------------|
| <p>Claim: The image label 2 and 3 represents Newton's Law of inertia.</p> | <p>Evidence:</p> |
| <p>Reasoning:</p>   |                  |

